

3
THE MYOLOGY
OF
CYCLOTHURUS DIDACTYLUS.

BY

JOHN CHARLES GALTON, M.A., F.L.S.,

LECTURER ON COMPARATIVE ANATOMY AT CHARING CROSS HOSPITAL*.



[Plate VIII.]

THROUGH the kindness of Prof. Flower, F.R.S., Conservator of the Museum of the Royal College of Surgeons, I have been enabled to examine the muscles of a specimen of the Two-toed Anteater (*Cyclothurus didactylus*, Lesson†). The animal was female, fairly developed, and measured from the tip of the

* Communicated by the Author, having been read at the Meeting of the British Association for the Advancement of Science, at Exeter, August 24, 1869.

† See 'Revision of the Genera and Species of Entomophagous Edentata,' by Dr. J. E. Gray, F.R.S. (Proc. Zool. Soc. April 1865, p. 385 and 19.

No mention is made of this species of Anteater either in the French edition (2 vols. Paris, 1801) of Don Felix d'Azara's Essays on the Natural History of the Quadrupeds of Paraguay, or in Dr. Rengger's 'Naturgeschichte Säugethiere von Paraguay,' Basel, 1830. In the first volume (the only one ever published), however, of an English translation from the original Spanish of the former author, by Mr. W. Perceval Hunter, F.G.S. (London, 1838), we are informed (p. 163) that "Buffon describes a third species of Anteater;" and the Don proceeds, somewhat scoffingly, to question the correctness of the observations of this unfortunate butt of naturalists, and thus concludes, after the fashion of a counsel on a losing side:—"Finally, I leave it to time to prove or disprove my conjecture." Time disproved his conjecture; and Buffon, for once in a way, is right. The translator, in some "Additional Notes" (p. 169), quotes from the Penny Cyclopædia' (vol. ii. pp. 63-66) a description of the habits of the anteater in question, which was taken from Von Sack's 'Narrative of a voyage to Surinam'—a work, as Mr. Hunter truly observes, "rarely met with."

I extract from the preface to Mr. Hunter's translation the Spanish titles of Azara's works, which were published in five octavo volumes:—

1. "Apuntamientos para la Historia natural de los Quadrupedos del Paraguay y Rio de la Plata, escritos por Don Felix de Azara, en dos tomos, en la imprenta de la viuda de Ibarra, Madrid."

2. "Apuntamientos para la Historia natural de los paxaros del Paraguay y Rio de la Plata, escritos por Don Felix de Azara, en tres tomos. Madrid, 1802."

snout to the extremity of the tail 15 inches, and from the tip of the latter to the anus $8\frac{3}{4}$ inches.

This is not the first time that the museles of this species of Anteater have been the subject of description either by pen or peneil, seeing that Meckel, at the beginning of the present century, published a paper on its anatomy in the 'Archiv' which bear his name*, and Cuvier devoted two plates of his splendid Atlas to the illustration of its myology†.

Since, however, the descriptions of the former author are somewhat lacking in completeness and fulness in certain points, and since the figures drawn by the latter, though from an artistic point of view faultless, are, for the stern needs of the dissector, "un faible secours," as remarked by M. Pouchet, it is hoped that the following notes will fill up any gaps which may still exist in the knowledge to which these great anatomists have so largely contributed‡.

Panniculus carnosus. This muscle is most developed in the abdominal region and flanks. The "portion ventrale" of Cuvier is, on either side of the middle line of the abdomen, fused with the aponeurosis of the external oblique; while dorsally it is continued into fascia covering the the intercostal museles and those of the back.

The outermost fibres of the ventral portion pass over the outer aspect of the thigh, and are lost in the fascia covering the outer side of the thigh and leg of either side, acting thus as a tensor fasciæ femoris externus (Cuvier, pl. 257. fig. 1, and pl. 258). This arrangement keeps the thigh semiflexed upon the abdomen.

The uppermost fibres, "portion latérale" (Cuvier, pl. 257. fig. 1, and pl. 258), split near their termination into two flat bundles, the innermost of which appears to become blended with the inferior surface of those fibres of the pectoralis major which take origin from the costal cartilages, while a few fibres seem to be prolonged as far as the first or second rib. The outermost bundle joins a small slip given off from that portion of the latissimus dorsi (namely, from its innermost edge) which furnishes the dorso-épitrochléen, which slip is continued into the inferior surface of the terminal tendon of the pectoralis major.

* "Anatomie des zweizehigen Ameisenfresser," Archiv für die Physiologie, Ver Bd. Halle & Berlin, 1819.

† Anatomie Comparée, recueil de planches de myologie dessinées par Georges Cuvier ou exécutées sous ses yeux par M. Laurillard. Fol. Paris, 1855, pls. 257 & 258.

‡ I should here state that Prof. Humphry had completed the dissection of a Two-toed Anteater before my labours had begun; but, as he intends reserving his notes for the next number of the 'Journal of Anatomy and Physiology,' he has, with great kindness and liberality, made no objection to the prior publication of observations which are, in point of time, of later date than his own.

The portion answering to the *platysma myoides* is but poorly developed.

There is no trace of a *musculus sternalis*.

The *rectus abdominis* is very well developed. As in *Dasypus*, it broadens out on reaching the thorax, over which it was prolonged, terminating at ribs 2 to 6, inclusive, by digitations corresponding to the point of origin of the *obliquus externus* from these ribs. The highest fibres, which are continuous with the inner edge of the muscle, are inserted into the second rib by an extremely delicate tendon, easily overlooked. There was no complete sheath for the muscle. The superficial surface was covered by the aponeurosis of the internal oblique; while the deep surface was, on its outer half, invested with the fibres of the *transversalis*, the inner half being covered by the aponeurosis of the same muscle, which probably, along the inner edge of the *rectus*, fused with that of the internal oblique muscle. The outer edge of the *rectus* was not bounded by any sheath.

This muscle, according to Meckel (Archiv, p. 40) has three "inscriptiones tendineæ" (Schnenstreifen), the middle one being the most conspicuous. Its thoracic attachment, according to the same authority, is to the eight uppermost costal cartilages. The tendinous bands were by no means clearly marked in the specimen which I examined.

There was a well-developed *rectus thoracicus lateralis*. It arose from about the seventh to the eleventh ribs inclusive, passed over the boundary-line of the insertions of the *serratus magnus* and the thoracic origin of the *obliquus externus*, and was inserted into the second rib, at about the junction of the costal with the sternal portion.

Since this muscle coexists with an upward prolongation of the *rectus abdominis*, it can scarcely be regarded as a "lateralized" slip of the *rectus*, as suggested by Prof. Macalister*. It is, moreover, completely separated from the *rectus* by a muscular stratum composed of the thoracic fibres of origin of the *obliquus externus*. Cuvier figures the muscle very clearly (pl. 257. fig. 2), but terms it "scalène, portion extérieure ou inférieure." In his plate of the myology of *Myrmecophaga tamandua* (pl. 262), it is represented as passing over the *serratus magnus*. I am inclined to regard this muscle, as evidently did Cuvier, as a downward detachment from the scalenus.

Mr. Wood describes a similar muscle as occurring in man, under the name of "supracostal" (Proc. Roy. Soc. June 1865, p. 3, and May 1867, p. 523). A like muscle, too, is recorded

* "On the Myology of *Bradypus tridactylus*," Ann. & Mag. Nat. Hist. July 1869, p. 55.

and figured as a human abnormality in Virehow's 'Archiv,' Nov. 1867 (Taf. 6. fig. 1).

The rhomboidei are fused together into one muscle. They arise from the upper third of the dorsal vertebral region, and are inserted along the whole of the superior (or posterior) costa of the scapula; covered by the trapezius. I did not find any occipito-scapular slip.

The trapezius arose from the occiput, from the spines of the cervical vertebræ, and from the vertebral spines in the upper third of the dorsal region. It was inserted along the posterior (superior) edge of the spine of the scapula, and into the distal fourth of the clavicle. Meekel notices (Archiv, p. 38) the clavicular insertion.

The aeromio-basilar was not present.

The serratus magnus was well developed. It seemed to be made up of three factors:—

1. The highest, evidently corresponding to the levator scapulæ, arose from the two or three lower cervical vertebræ, and was inserted into the superior angle of the scapula and, for some little distance, along the superior costa of the bone, being overlapped by the highest fibres of origin of the rhomboideus.

2. The smallest factor, inserted into the inner face of the scapula, internal to the division just described, arose from the first rib, just external to the insertion of the scalenus anticus, with the outermost fibres of which muscle it appears to be in intimate connexion.

3. The lowest, corresponding to the serratus magnus of anthropotomy, arose from the second to the seventh ribs, inclusive, external to the rectus abdominis, being overlapped at its origin by the outer border of this muscle. A few fibres, too, arose from the first rib, in a space included between the insertion of the scalenus and the rectus lateralis. The insertion was at the inferior angle of the scapula and part of the axillary costa of this bone.

There was no trace of an omohyoid on either side. This muscle seems to be absent in all the Edentata. Prof. Hyrtl describes it as wanting in *Chlamydophorus**.

The levator claviculæ was absent.

The sterno-cleido-mastoid arose from the mastoidal and adjacent portion of the occipital region of the skull, the sternal factor being most anterior. The cleido-mastoid portion had a broad fleshy insertion into the middle third of the clavicle, the outermost fibres being in a line with the innermost fibres

* "*Chlamydophori truncati* cum *Dasypode gymmuro* comparatum examen anatomicum" (Denkschrift. der k. Akad. der Wissenschaft. in Wien, ix. Band, 1855).

of origin of the deltoid. The sterno-mastoid had a tendinous insertion at the junction of the clavicle with the sternum (into the "omo-sternal" element of Parker), but had no prolongation over the pectoralis major, being, in fact, completely covered by the upper edge of the muscle.

The subclavius is absent, as it is in *M. jubata* and *tamandua*. This muscle, according to Prof. Hyrtl, is "egregie evolutus" in the *Chlamydophore*.

The deltoid was very well developed, and appeared to be made up of three factors:—

1. Clavicular, the largest, arose from the scapular half of the inferior edge of the clavicle and from the acromion, and was inserted into the upper part of the deltoid tuberosity above the origin of the brachialis anticus.

2. Acromial, arose from the upper half of the spine of the scapula, and was inserted into the humerus just posterior to the origin of the supinator longus.

3. Spinous, took origin from the middle third of the spine of the scapula, and was inserted beneath the preceding division of the muscle.

According to Hyrtl, the deltoid has no clavicular portion in *Chlamydophorus*.

There was nothing worthy of note in the supraspinatus.

The infraspinatus and teres minor were fused together.

The subscapularis had the usual point of attachment.

The teres major was enormously developed. The bulk of the muscle arose from the lower half of the axillary costa of the scapula, but was joined by a thin stratum of muscular fibres which took origin from the whole of that portion of the spine of the scapula which lies posterior to the origin of the second division of the deltoid, a pouch being thus formed the concavity of which looked upward. The muscle was inserted along the whole length of the inner edge of the shaft of the humerus, the lowest fibres terminating at a ridge situated above the inner condyle. Cuvier evidently regarded this muscle as a portion of the triceps. Those fibres which arose from the scapular spine he held to be an accessory factor ("extenseur venant de l'épine de l'omoplate," pl. 257. fig. 1). If the whole of the muscle is not to be regarded as the teres major, that portion, at any rate, which arises from the costa of the scapula must be considered as such, while those fibres which arise from the scapular spine may be regarded as a portion of the triceps which has fallen short of its insertion.

No part of this enormous muscle reached the olecranon, no fibres, in fact, passing below the foramen in the humerus which transmits the median vessels and nerve.

Cuvier represents the teres major in the Two-toed Anteater

as a small muscle which becomes fused with the latissimus dorsi before insertion (pl. 257. fig. 3).

This muscle is stated by Meckel (Archiv, p. 42) to be "sehr stark." Beside a humeral attachment similar to that just described by me, a portion of the muscle is said to pass to the olecranon, and thus to be adjutant to the extensor of the forearm, as a factor of which muscle it is finally regarded by Meckel.

The muscle which I have termed *teres major* was supplied, on the inner aspect of the arm, behind the tendon of the latissimus dorsi, by a nerve (subscapular?) given off from the lower of the two factors of the axillary nerve.

Latissimus dorsi. A few fibres continued from the innermost edge of this muscle are joined, at a point where the muscle divides into its humeral and dorso-epitrochlear portions, by the outermost of the two slips into which the ventral panniculus splits at its upper part. This compound slip joins the inferior surface of those fibres of the *pectoralis major* which are derived from its upper stratum, at their junction with the terminal tendon.

The above-described offset from the latissimus dorsi evidently answers to a muscular "abnormality" occasionally found in man, and termed "*Achselbogen*" by the German anatomist Langer. It is, however, regarded by Prof. Macalister (*loc. cit.* pp. 54, 55) as a fourth pectoral muscle.

Where the above-mentioned fibres diverge from the dorso-epitrochlear factor, a slip arose from the internal surface of the muscle, and soon passed into a stout flat tendon, which, passing between the median and circumflex vessels and nerves, ends at the humerus beneath the middle portion of the terminal tendon of the *pectoralis major*.

The dorso-építőchlien, instead of being a continuation of the latissimus dorsi, appears rather to be tacked on to its outer edge by a kind of faint tendinous seam. This offset passes as a thin, but quite distinct, muscular investment over the olecranon, along the flexor aspect of the forearm, and terminates in the palmar fascia.

Over the dorso-építőchlien passes the internal cutaneous nerve, which runs over the flexor surface of the forearm as far as the wrist.

The *pectoralis major* had no clavicular origin. At the uppermost portion of its sternal origin it can be divided into two more or less distinct strata, with the inferior (deep) surface of the lowest of which the panniculus carnosus is connected. The upper stratum of the muscle joins the lowest portion of the terminal tendon, the lower the uppermost—enclosing thus a sac having the concavity upwards.

The tendon is inserted along the ridge running from the external tuberosity to the deltoid trochanter.

A layer of connective tissue, but no fascia, intervenes between the two layers into which the muscle may be differentiated.

The pectoralis minor is absent, unless the lowermost of the two layers of the pectoralis major just mentioned be regarded as its homologue.

Of the coraco-brachialis I could not find a trace on either side, not even of the "short" variety of Wood. This muscle, which is usually present, in one of its three forms at least, in mammals, is wanting also in the Chlamydophore, according to Prof. Hyrtl.

The biceps was single-headed. Halfway down the arm its most posterior fibres separate, and fuse with the brachialis anticus, while the anterior portion of the muscle is continued into a stout rounded tendon, which is inserted into a strong tubercle projecting from the palmar surface of the radius. This part of the muscle must act as a strong supinator. That portion of the biceps which is blended with the brachialis anticus is inserted in company with this muscle into the ulna.

The biceps arises by a flat tendon from the superior edge of the glenoid cavity of the scapula, and passes over the head of the humerus, covered by the capsular ligament.

The brachialis anticus takes origin from the anterior and external aspect of the humerus, below the deltoid tuberosity.

The triceps is made up of the usual factors. The "long head" of anthropotomy takes origin from the upper fourth of the axillary costa of the scapula, just posterior to the glenoid cavity, and joins that portion of the muscle which rises from the humerus. This latter portion is bifid at origin, the musculo-spiral nerve passing between the two heads, one of which arises from the posterior surface of the shaft of the humerus, as high up as the neck of the bone, while the other takes origin immediately behind the insertion of the deltoid, and is joined by the "long" head.

From that portion of the humerus which answers to the olecranon-fossa of human-anatomy language arise some fibres (anconeus) which join the main body of the muscle. These are limited above by the musculo-spiral nerve, from which they receive a special branch. The insertion of the triceps was as usual.

There was a well-developed epitrochleo-anconeus, passing from the internal condyle to the olecranon, and having the usual relation to the ulnar nerve.

The supinator longus was well developed. It arose from a ligament stretched between the deltoid tubercle and the "su-

pinator ridge" of the humerus. Before reaching its insertion it separates into two strata, the lower of which terminates at the distal extremity of the radius, while the upper is lost in fasciæ covering the inner and dorsal aspects of the wrist, and also joins obliquely the anterior annular ligament of the carpus. The lower layer seems to be in its turn differentiable into two strata. To the muscle is distributed branches from the posterior interosseous nerve, just anterior to the emergence of the musculospiral nerve from beneath the ligamentous bridge mentioned above.

The upper stratum of the supinator longus is thus described in the explanation of Cuvier's plates:—"Muscle propre (G. Cuvier) c'est un 2^e long supinateur" (pl. 257. fig. 1, & pl. 258).

The supinator brevis was also well developed. It arose from the external condyloid ridge of the humerus, covered by the origins of the common extensor and of the extensor ossis metacarpi pollicis, and was inserted along the whole of the outer edge of the radius, coextensively with the radial origin of the flexor profundus. The muscle was pierced at its origin by the posterior interosseous nerve.

The extensor carpi radialis arises from the humerus, immediately below the supinator longus. It is a large, but single muscle. It becomes tendinous at the distal third of the forearm; and the tendon passes under a ligamentous pulley at the wrist-joint, to be finally inserted into the radial side of the third metacarpal bone, being previously crossed by the "dorsal interosseous" muscle (Cuv.), which passes to the terminal phalanx of the index.

The extensor ossis metacarpi pollicis arises from the external condyloid ridge, in company with the extensor communis digitorum and the extensor minimi digiti. It passes obliquely (the hand being pronated) over the tendon of the extensor carpi radialis, and is inserted by a strong tendon into the rudiment of the pollex (or trapezium?).

The extensor communis digitorum takes origin from the external condyloid ridge of the humerus, immediately below the extensor carpi radialis, but in company with the muscle just described. At the carpal joint its tendon is closely bound down by a strong ligament stretched between the distal end of the radius and the dorsal surface of the euneiform bone, and terminates at the dorsal aspect of the base of the distal phalanx of the third ("middle") digit, being reinforced, close to its termination, by a short extensor (dorsal interosseous, Cuv.) on either side.

The extensor brevis digitorum manus, a kind of accessory extensor muscle, arose from the distal end of the dorsum of the ulna, and from the dorsum of the os magnum and unciform

bone. The principal portion of the muscle passes to either side of the tendon of the extensor communis, just short of its termination at the nail of the third digit. A thin slip, given off from the radial side of the muscle, and which also arises from a ligament joining the scaphoid and lunar bones, is inserted by tendon into the base of the ungual phalanx of the index. This muscle, to which the symbol of the dorsal interosseus is appended in Cuvier's plates, answers to one which Prof. Macalister describes (*loc. cit.* p. 62) as present in *Bradypus*, and which "seems," he says, "to contain the displaced germs of the dorsal intercrossei."

From the external condyle of the humerus, immediately below and in company with the extensor minimi digiti, and from the proximal two-thirds of the outer surface of the ulna, arises a muscle which is inserted by tendon into the ossicle (rudiment of fifth digit) which lies to the ulnar side of the unciform bone and the rudiment of the fourth digit. This is not improbably the extensor carpi ulnaris.

A well-developed muscle takes origin from the external condyloid ridge, in company with the extensor ossis metacarpi pollicis and the extensor communis, and has a broad tendinous insertion into the ulnar side of the base of the proximal phalanx of the third digit. This may be a displaced extensor annularis or extensor minimi digiti.

The pronator teres, a muscle of uniform width, arises from the ridge above the inner condyle, and is inserted by a flat tendon into the distal end of the radius, being covered at its insertion by the lower layer of the supinator longus. There was, as seems to be the case in all Edentata yet examined, no trace of a coronoid head*.

The pronator quadratus was exceedingly well developed. It covers the palmar surface of the radius and ulna from their distal end up to the insertions of the biceps and brachialis anticus. Meckel makes no mention of this muscle, nor does it appear in Cuvier's plates. The pronator quadratus is present in all Anteaters, both American and African.

A muscle (palmaris longus?) arises from the olecranon, in close connexion with the dorso-épitrochlien. Its tendon passes to the radial side of the wrist, where it terminates in the palmar fascia.

A large mass of muscle arose from the tip of the pisiform bone, and was attached on one side to the rudiments of the fourth and fifth digits, on the other to the rudimentary pollex, while anteriorly it was continued into the palmar fascia.

The muscles attached to the pisiform, one of the most impor-

* Prof. Macalister, "On the Nature of the Coronoid Portion of the Pronator Radii Teres," *Journ. Anat. & Phys.* ser. 2. vol. i. p. 9.

tant bones, *functionally* considered, in the manus of the animal with whose anatomy we are concerned, are very numerous; but their homologies are by no means easy of determination*.

From the lowest portion of the inner condyloid ridge of the humerus rises a muscle (flexor carpi ulnaris?) which soon divides into two slips, the upper of which terminates by tendon at the anterior part of the os pisiforme, while the inferior slip has a broad fleshy attachment to the lower or palmar surface of the same bone.

A muscular mass arose from the lower third of the dorsum of the ulna, and was inserted into the upper part of the pisiform bone.

Another and larger mass took origin from nearly the whole length of the inner (ulnar) edge of the ulna, and was inserted into the pisiform immediately below the muscle just described.

Cuvier figures (pl. 257. fig. 1) a muscle as arising from the lower third of the ulna and terminating at the tip of the pisiform bone: this he terms "abaisseur du pisiforme."

Meckel describes a muscle coming from the tip of the olecranon, and inserted at the inferior free edge of the pisiform, which bone it draws away from the two great fingers (*i. e.* index and digitus medius). Another muscle (according to him, lying in the same plane) takes origin from the distal end of the ulna, and is also inserted into the pisiform, which it draws outwards and backwards. This seems to answer to the "abaisseur" of Cuvier.

An analogous muscle, he says, arises from the flexor tubercle of the humerus, and is attached to the anterior end of the tip of the pisiform, of which it is likewise an abductor.

These muscles, of which I have given both Meckel's and my own description, appear to be factors of a highly differentiated flexor carpi ulnaris.

From the internal condyloid ridge, immediately below the origin of the pronator teres, and covering the origin of the flexor carpi radialis, arises the flexor sublimis of the third digit. Immediately below, and in company with the condyloid origin of the flexor profundus and flexor carpi ulnaris, the flexor sublimis of the index arises. Their tendons pass over the anterior annular ligament of the wrist, and, after splitting to allow of the passage of the tendons of the deep flexor, are inserted into either side of the distal end of the first phalanx of their respective digits.

The flexor profundus has two large heads of origin:—

* "Die Beugeseite der Hand," says Meckel (Archiv, p. 47), "enthält dagegen wenigstens sechs verschiedene, kleine Muskeln, welche grösstentheils dem grossen Erbsenbein angehören."

1. From the upper half of the ulnar edge of the radius, being coextensive with the insertion of the supinator brevis.

2. To a like extent from the inner (ulnar) edge of the ulna, and from the homologue of the coronoid fossa of anthropotomy*, also by a strong tendon from the internal condyloid ridge. The stout common tendon passes under the anterior annular ligament (which intervenes between it and the superficial flexors); and its terminal branches pass to the bases of the ungual phalanges of the two functional digits.

A thin muscular slip arises from the tendon of origin of the flexor profundus from the condyle, and is inserted by a delicate tendon into the dorsal aspect of the anterior annular ligament.

A strong ligamentous strap binds down the tendons of the flexores sublimis and profundi at the point where the latter pierce the former.

According to Meckel (Vergleich. Anat. iii. p. 559), the third digit only has a "perforated" flexor.

The slip which passes to the annular ligament seems to be a rudimentary homologue of a muscle which is present in *M. tamandua*, and is termed by Rapp (Anat. Untersuch. über die Edentaten, p. 48) "*Spannmuskel des Ligamentum annulare*."

The tendon of the deep flexor does not contain any sesamoid bone.

From the ulnar side of the deep flexor tendon of the third digit, just before it passes under the "perforated" flexor, is given off a comparatively small tendinous slip, which becomes muscular, and has a fleshy attachment to the radial side of the last division of the rudimentary fourth digit.

From the angle formed by the junction at origin of the deep flexor tendon of the index with the tendon for the third digit rises a vermiform muscle, similar to the one just described, which is attached to the radial side of the proximal phalanx of the third digit.

These two muscles are probably lumbricales—muscles which, according to Prof. Macalister (Ann. & Mag. Nat. Hist. July 1869, p. 61), are absent in the *Ai*.

The interossei are five in number:—

1. A fairly developed muscle, arising by a tendon from the inferior process of the unciform bone, and passing to the ulnar side of the base of the proximal phalanx of the third digit.

2. Above this arises, from the ulnar side of the unciform process, another and smaller muscle, which passes to the rudiment of the fourth digit.

* This slip appears to answer to one which I have described and figured (Trans. Linn. Soc. vol. xxvi. p. 546, and pl. 44. fig. 1) as existing in *Dasypus*.

3. A fair-sized muscle, terminating at the ulnar side of the proximal phalanx of the index, and arising from the middle of the palm, from adjacent parts of the bones of the two metacarpals.

4. A delicate muscle arises from the uniform bone, covered by the muscle described above as passing to the third digit. It runs obliquely across the palm; and its delicate tendon seems to join the muscle which goes to the index.

5. To the radial side of the proximal phalanx (metacarpal?) of the index passes a muscle from the rudimentary pollex (trapezium?).

The gluteus maximus was represented by a thin muscular sheet inserted by a strong tendon into the middle of the outer edge of the femur, at about the point where the third trochanter would be looked for. According to Meckel (Archiv, p. 48, and Vergleich. Anat. p. 577), the insertion is along the *whole* of the outer edge of the femur. The tendon is continuous anteriorly with the fascia in which the "portion ventrale" (Cuv.) of the panniculus terminates. The muscle arises from the crest of the ilium and from that edge of the bone which is in apposition to the sacral vertebræ, also from an aponeurosis which covers the origin of the caudal muscles.

The gluteus medius is a thick muscular mass which takes origin from the whole of the external (gluteal) fossa of the ilium, and is inserted into the upper and outer aspect of the trochanter major. The lower border of the muscle is separated from a subjacent muscle (the quadratus femoris?) by the sciatic vessels and nerve.

I can confirm Meckel's statement (Archiv, p. 49) that no gluteus minimus is present—that is to say, separable from the gluteus medius. All three glutei are, according to Rapp (*op. cit.* p. 50), present in *M. tamandua*.

A large muscle arises from the obturator foramen, and forms its pubic and ischial boundaries, and is inserted into the inferior part of the great trochanter. This is probably the obturator externus; but it closely resembles the muscle figured by Cuvier (pl. 257. fig. 2) as quadratus femoris.

A muscle, fan-shaped, tapering to its insertion at the under surface of the great trochanter, betwixt the insertion of the gluteus medius and the muscle just described, takes origin from that part of the ischium which lies below (or posterior to) the acetabulum. This muscle, which is most probably the quadratus femoris, though it may possibly be the homologue of either the pyriformis or the gemelli, is covered by the origins of the biceps and semitendinosus; and the sciatic nerve, moreover, passes over it. Cuvier attaches to it (pl. 257. fig. 2) the symbol of the pyriformis.

The *psoadiliacus* has an extensive insertion, the iliac portion being prolonged for some distance on the shaft of the femur. The *psosas factor* is chiefly inserted into the lesser trochanter. The iliac portion is separated from the *psosas parvus*, just before the latter becomes tendinous, by a nerve (the external eutaneous?). A few fibres from its external edge are prolonged on to the *reetus femoris*, and blend with it.

The *psosas parvus* (which is not represented in Cuvier's plates) is inserted by a strong shining tendon into a small and sharp tubercle lying in advance of the root of the slightly convex inner face of the ilium and the junction of the *os pubis* with this bone.

As the animal was so "well ribbed home," to use a veterinary expression, I could not examine the origins of the *psosas parvus* and *psoadiliacus*, a perfect skeleton being required for the museum of the College of Surgeons.

The *pectineus*, a well-developed, fan-shaped muscle, arose from the superior edge of the iliac portion of the pubis, covered by the highest fibres of origin of the *gracilis*, and had a fleshy insertion into the inner side of the femur from below the lesser trochanter to a point just above the inner condyle.

The adductors seemed to be represented by two muscles.

1. arose from the rest of the anterior ramus of the *os pubis*, in advance of the *pectineus*, as far as the symphysis. It soon split into two slips, one of which was inserted tendinously into the lower surface of the femur, slightly in advance of the insertion of the *pectineus*, while the other terminated (partly fleshy, partly tendinous) at the inner condyle, above and covering the insertion of the superior factor of the *semitendinosus*.

2. took origin from the same portion of the pubic bone as the preceding, lying between it and part of the origin of the *gracilis*. It widens out gradually toward the insertion, which is into nearly the whole length of the outer part of the inferior surface of the femur, being coextensive with the origin of the femoral portion of the *biceps*.

A small muscle arising from the pubis, below the lowest fibres of origin of the *pectineus*, was inserted into the intertrochanteric space on the inferior surface of the femur.

The *quadriceps extensor* did not present any peculiarities worthy of note.

The *sartorius* arose from strong fascia attached to the tendon of the *psosas parvus*, and from Poupart's ligament, and was inserted, above and slightly external to the *gracilis*, into the tibia, close to the boundary of the articular surface of the bone. Part of its terminal tendon appeared to be prolonged upwards to the patella. A like inward displacement of the *sartorius*

from its usual origin has been described by Meekel (Vergleich. Anat. iii. p. 614) and Prof. Macalister (*loc. cit.* p. 64) as taking place in the Aï, by Krause* in the Rabbit, by Prof. Hyrtl in the Chlamydophore†, and by myself (Trans. Linn. Soc. vol. xxvi. pp. 553, 592) in *Dasypus* and *Orycteropus*.

The gracilis has a <-shaped origin (left side) from the edge of the os pubis, and for about two-thirds of the ischio-pubic bone, and is inserted by a broad tendon into the upper third of the inner edge of the tibia, the upper terminal fibres covering the strong internal lateral ligament.

The semitendinosus took origin in two slips from the tuber ischii.

1. The superior, which was fused with the biceps at origin, was inserted into the posterior part of the inner condyle of the femur, just below the insertion of the adductor, and posterior to the internal lateral ligament.

2. The inferior rises just below the former, covered by the most inferior fibres of origin of the gluteus maximus, and joins the middle of the terminal tendon of the gracilis, being covered by this muscle at insertion.

The semimembranosus arises from the tuber ischii below the second portion of the semitendinosus, covered by the lowest fibres of origin of the gracilis, and is inserted tendinously into the tibia, posterior to the internal lateral ligament, and midway between the terminations of the two fascicles of the semitendinosus. Cuvier represents (pl. 258. fig. 2) this muscle as made up of two slips, which are inserted just above the "aecessoire fémoral du demi-nerveux."

The biceps femoris arose from the tuber ischii in company with the superior division of the semitendinosus, and was inserted into the outer part of the tubercle of the tibia which affords insertion to the ligamentum patellæ by a strong tendon continuous with the fascia covering the outer aspect of the leg.

An accessory portion (Cuvier), quite distinct from the above, fan-shaped, took origin from that part of the outer edge of the femur which is included between the great trochanter and the termination of the gluteus maximus. It gradually tapered towards its insertion (passing in its course over the peroneal nerve), which was effected by tendon into the fibula, at the junction of its third with its lowest fourth.

The gastrocnemius was made up, as usual, of two muscular bellies:—

1. Outer, rising from the outer aspect of the external con-

* Die Anatomie des Kaninchens, p. 116. Leipzig, 1868.

† "*Sartorius insolita plane excellit origine, dum non ab ossis ilei spina, sed a tendine psico enascitur.*"

dyle, between the origin of the plantaris and the external lateral ligament, the innermost and deeper fibres of origin arising from the sesamoid from which the popliteus takes origin.

2. Inner and larger, rising from the inner and inferior surface of the internal condyle. These bellies unite, about half-way down the calf, into a tendo Achillis, which is inserted into the calcaneum.

The soleus, a very well-developed muscle, arose from the fibula for about three-fourths of its length, and was inserted by a strong tendon into the calcaneum, in advance of the tendo Achillis.

The popliteus was well developed. It arose from an elongated sesamoid bone (Meckel, Archiv, pp. 28, 53) which projects at the inferior aspect of the knee-joint, posterior to the external lateral ligament. It then passed obliquely downwards to its insertion at the upper third of the tibia, the lower border of its terminal portion blending with the tibial fibres of origin of the tibialis posticus.

A similar sesamoid is present in the head of the popliteus in the Aï, according to Meckel (Vergleich. Anat. iii. p. 635) and Prof. Macalister (*loc. cit.* p. 66), and in *Nycticebus tardigradus*, according to Mr. Mivart and Dr. Murie (Proc. Zool. Soc. Feb. 1865, p. 251). It is significant that Prof. Macalister has recorded (Journ. of Anat. ser. 2. vol. ii. p. 108) the occurrence of a sesamoid in the tendon of origin of the supinator brevis in a female human subject, which muscle he considers to be the serial homologue of the popliteus.

The plantaris arose from the lower surface of the femur, behind the external condyle, in advance of the origin of the femoral head of the biceps. The muscle is continued into a long slender tendon, which passes under the gastrocnemius to the inner side of the leg, and, after broadening out, is inserted partly into the calcaneum, partly into the extremity of the strigil-shaped accessory bone of the tarsus. The termination of this muscle is unlike that which is usual in the Edentata (Macalister, *loc. cit.* p. 66), since it is not prolonged into the sole.

The tibialis posticus arose from the middle of the posterior surface of the tibia, just below the insertion of the popliteus, with which it is here blended, also from the posterior part of the head of the fibula. Its tendon passes under a strong ligamentous pulley at the internal malleolus, and is inserted into the fibular and inferior aspect of the strigil bone, not far from its free extremity.

A muscle arose from the inner aspect of the head of the

fibula, covered by the origin of the tibialis posticus. It soon became tendinous; and its long tendon passed obliquely to the inner side of the calf, and at the inner malleolus ran under a pulley situated posterior to and slightly below that under which the tendon of the tibialis posticus passes. It was inserted into the fibular side of the strigil bone, close to its base and in advance of the insertion of the tibialis posticus. This muscle, if not a differentiated slip of the tibialis posticus, which it most probably is, may be the flexor longus hallucis. Prof. Hyrtl describes, under the name of "tibialis posticus accessorius," a similar muscle as present in *Chlamydophorus*, "qui tibialem posticum viæ comitem laborisque socium legit." I found a like muscle in *Dasypus* (Trans. Linn. Soc. xxvi. p. 558); and Mr. Wood records (Proc. Roy. Soc. June 1865) the occasional occurrence of such in the human subject.

The flexor longus digitorum was a strong bipenniform muscle, arising from the upper three-fourths of the tibia and fibula. It became tendinous on reaching the sole; and the branches of its tendon terminated each at one of the four functional digits of the foot.

The flexor accessorius was well developed, and arose from the under surface of the calcaneum, and, passing obliquely inwards across the plantar aspect of the tendon of the common flexor, was inserted into it just posterior to its division into digital slips.

The peronei were three in number. They all arose from the upper part of the fibula; and their tendons passed through a strong ligamentous pulley stretched between the external malleolus and the calcaneum.

The most anterior at origin (peroneus longus) took origin in close company with the origin of the long extensor of the toes. Its tendon lay outermost of the peroneal tendons, under the ligamentous band, soon after leaving which it passed under a second pulley situated on the fore part of the calcaneum, and, running along the fibular side of the foot, passed into the sole along the plantar aspect of the cuboid bone, and was finally inserted into the fibular side of the scaphoid, on its plantar aspect. This muscle was separated from the other peronei, at origin, by the peroneal vessels and nerve. Its tendon did not send any offset to the fifth digit.

The two other peronei were fused into one muscle; but in the ligamentous pulley the compound tendon divided into two unequal slips, the smaller of which passed to the side of the base of the proximal phalanx of the fifth digit (peroneus tertius or quinti digiti?). The other, and by far the largest, slip terminated at a tubercle on the base of the fifth metacarpal, broadening out at its insertion (peroneus brevis).

The *tibialis anticus*, a very well-developed muscle, arose from the upper half of the tibia and from the middle third of the fibula. Its very strong single tendon passed under the common annular ligament, to be inserted into the posterior and inferior process of the ento-cuneiform bone, covering at insertion a transverse ligament passing from this bone to the base of the strigil bone.

Meckel (Vergleich. Anat. p. 624) describes this muscle as having two heads of origin, but states that the tendon terminates at the rudimentary hallux.

The *extensor communis digitorum* arose from the head of the fibula, in company with the *peroneus longus*, and from the adjacent part of the tibia. Its tendons passed under the broad, common (annular) ligament, and then under a very strong ligamentous bridge (proper to it alone) which is fastened to a process from the anterior part of the astragalus. On the dorsum of the foot it expanded into a web which was fastened to the bases of the proximal phalanges of the toes, including the rudimentary hallux, and was also, except in the case of the latter digit, continued to the root of the ungual phalanx of each toe, being reinforced at the sides of the digit by the tendons of the *interossei*.

The *extensor brevis digitorum* was well developed. It arose from the upper and anterior portion of the *os calcis*, from the anterior part of the astragalus, and from the fibular side of a strong ligament passing from the latter bone to the entocuneiform. It appeared to be divisible into four slips, the innermost of which was continued into a tendon which pierced the aponeurotic web of the common extensor tendon at the base of the proximal phalanx of the second toe, and then ran along the dorsal aspect to the tip of the hallux.

The three outer slips seemed to be inserted principally into the bases of the proximal phalanges of the three outer toes, besides being connected with the under surface of the expansion of the common extensor tendon.

The *extensor proprius hallucis* arose from the lower fourth of the fibula, and became tendinous on reaching the dorsum of the foot. The long slender tendon joined the aponeurotic web of the common extensor tendon at the metacarpal of the second digit.

A large muscle arose, partly fleshy, partly tendinous at origin, from the whole length of the inferior edge and fibular side of the strigil bone, and, by means of a tendon, from a tubercle on the inferior surface of the astragalus. It had a broad fleshy insertion into the base of the rudimentary hallux (*abductor hallucis*?). By means of those fibres which pass to

the astragalus, it would seem that the strigil bone could be slightly raised and approximated to the calcaneum.

From a ligament stretched across the sole at the line of articulation of the first with the second row of tarsal bones, arose a muscle which passed to the fibular side of the base of the rudimentary hallux. This is not improbably the representative of the adductor hallucis.

The muscles proper to the fifth digit were as follow :—

A long fusiform muscle arose from the inferior surface of the os calcis, and, after passing beneath the flexor accessorius, terminated at the fibular side of the base of the proximal phalanx (abductor digiti quinti?).

Another arose from the outer side of the os calcis, and was inserted into the tubercle at the base of the metacarpal (flexor brevis digiti quinti?).

A muscle was inserted into the fibular side of the base of the proximal phalanx, which appeared to arise from the tubercle of the metacarpal. Is this an interosseous muscle, or is it an anterior segment of the flexor brevis?

The lumbricales were three in number. They arose from the common tendon of the flexor communis, at the angle of origin of the branches destined for each toe. They appeared to pass to the tibial sides of the three outermost toes, and to terminate by delicate tendons at the point where the deep flexor tendons are bound down to the toes by ligamentous straps. Meckel makes no reference to them, nor does Cuvier figure them.

The interossei were very well developed, being stronger than those of the palm. They were seven in number, and arose from the plantar surface of the second row of tarsal bones. Each ended in a broad tendon, which joined on either side the extensor tendon of its proper digit. Each toe, the fifth excepted, had one on either side, the latter only on its fibular side. The hallux had none. On the extensor surface of the foot, from the ligament connecting the astragalus with the ento-cuneiform bone, and from the side of this latter, passed a muscle to the tibial side of the proximal phalanx of the second digit. This is the *tibial* interosseus of the second digit.

Superficially, on the plantar aspect of the foot, lies a large muscle, which is attached on one side to the strigil bone, and on the other to the metatarsal tubercle of the fifth digit, as well as to a ligament passing from this to the calcaneum. This muscle seems to correspond, *functionally* at any rate, to the large palmar muscle which is attached to the pollex and to the pisiform bone.

The ligamentum teres of the hip-joint was well developed. It is absent in *Bradypus*, according to Prof. Macalister (*loc. cit.* p. 65) and according to Meckel. Rapp (*op. cit.* p. 45) remarks that it is absent in the Sloths and the *Manis*.

Though the carpal and tarsal bones of the Two-toed Anteater have been described both by Meckel and Cuvier, I am not aware that they have ever been figured in detail; for though there is an excellent representation of the complete skeleton of the animal in De Blainville's '*Ostéographie*,' the number and arrangement of these bones can by no means with certainty be determined. I have therefore thought it advisable, notwithstanding that my paper professes to deal with myology only, to add a plate comprising figures of the fore and hind paws and the carpal and tarsal bones of this curiously modified Anteater.

That which Brants* has remarked relative to the muscles of the limbs of the Sloths appears to be fairly applicable to the Two-toed Anteater, namely, "*Vires motrices anticae corporis partis esse, posticam vero validis musculis ad anteriorem attrahi atque hujus motus sequi debere*,"—and the more so when we contrast the short humerus, rugged with strong muscular ridges, with the long smooth femur, which lacks even a rudiment of a third trochanter.

In addition to a long prehensile tail (at best but a stunted member in the sloths), naked for the lower third of its length, the fore and hind feet (Pl. VIII. figs. 1 to 4) are marvellously modified for arboreal progression, the functional absence of the pollex being compensated for, as Meckel hints (*Archiv*, p. 48), by the enormous development of the pisiform bone (figs. 5 to 8), to which are attached numerous strong muscles, while a long strigil-shaped bone† (fig. 11), passing backward from the

* *Dissertatio Zoologica Inauguralis de Tardigradis*, p. 27. Lugdun. Batav. 1828.

† This bone, termed "*schaufelförmiger*" by Meckel, is not unlike the instrument used by the Romans when perspiring in the bath: hence the name which I have applied to it. Those who prefer a long Latinized name, may call it *strigiliform*. Meckel considered that it was probably a homologue of the bone which carries the spur in the *Ornithorhynchus*; and Cuvier, in his '*Ossemens Fossiles*' (nouvelle édit. Paris, 1823, tome v. 1^{re} partie, p. 108), makes the following remarks relative to its probable function:—"Un os surnuméraire articulé sur le cunéiforme interne, et qui, dans le Tamanoir, le Tamandua, et les Pangolins, est triangulaire et fort petit, mais qui, dans le petit Fourmilier, s'allonge et s'élargit de manière à former une sorte de talon; il est vrai que dans cette espèce le calcanéum est extraordinairement court, ne se portant point en arrière plus que l'astragale lui-même. Cet os surnuméraire est ce qui donne à la plante du pied du petit Fourmilier cette forme concave qui la rend si propre à embrasser les branches et à grimper aux arbres."

scaphoid, more than makes up for the comparative shortness of the calcaneal process.

EXPLANATION OF PLATE VIII.*

- Fig. 1.* Right fore foot, inner side.
Fig. 2. Foreshortened palmar view of the same.
Fig. 3. Right hind foot, inner side.
Fig. 4. Plantar surface of the same.
Fig. 5. Dorsal view of radius and ulna and proximal row of carpal bones, left side.
Fig. 6. Dorsal view of carpal and metacarpal bones, right side.
Fig. 7. Palmar aspect of the proximal row of the carpal bones, left side†.
Fig. 8. Lateral view (ulnar) of carpal and metacarpal bones, right side‡.
Fig. 9. Dorsal view of metacarpals and phalanges, left fore foot.
Fig. 10. Lateral view (radial) of the same.
Fig. 11. Inner view of bones of left hind foot.
Fig. 12. Right hind foot, fibular view.
Fig. 13. Tibial view of the same (the strigil bone being removed).

Fore foot :—

<i>ul.</i> ulna.	<i>ps.</i> pisiform.
<i>r.</i> radius.	<i>mg.</i> magnum.
<i>sc.</i> scaphoid.	<i>un.</i> unciform.
<i>l.</i> lunar.	<i>mc.</i> metacarpal.
<i>c.</i> cuneiform.	<i>ph.</i> phalanx.

Hind foot :—

<i>t.</i> tibia.	<i>st.</i> strigil bone.
<i>f.</i> fibula.	<i>ic.</i> internal cuneiform.
<i>cl.</i> calcaneum.	<i>mc.</i> middle „
<i>cb.</i> cuboid.	<i>xc.</i> external „
<i>sc.</i> scaphoid.	<i>mt.</i> metatarsal.
<i>as.</i> astragalus.	<i>h.</i> hallux.

The numbers II. III. IV. V. indicate digits.

* The figures of bones are taken from a non-articulated skeleton, somewhat imperfect, belonging to the Royal College of Surgeons.

† The os lunare on this side was divided into two bones of equal size, but was single on the right side of the skeleton, and on both sides in the specimen which I dissected. Whether this division be due to a fracture, which is improbable, or be the result of a development from two distinct osseous centres, is a doubtful question.

‡ The mechanism of the grasping-action of the fore foot appears to be as follows :—The pisiform, by the contraction of the large palmar muscle, is brought into a line with the long axis of the forearm; the flexor muscles contract; but the third metacarpal cannot be brought into a position of less than a right angle with the pisiform, owing to the impingement of the downward process of the unciform against the latter bone; the ungual phalanges, however, of the two functional digits, free to act, are drawn down into apposition against the vicarious pollex.



